AD-A257 811

N PAGE

2

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	Nov 12, 1992	Reprint

4. TITLE AND SUBTITLE

Photoelectric Analysis of the Solar Granulation in IR

5. FUNDING NUMBERS

PE 61102F
PR 2311
TA G3
WU 27

6. AUTHOR(S)

Serge Koutchmy

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Phillips Lab/GPSS
Hanscom AFB
Massachusetts 01731-5000

8. PERFORMING ORGANIZATION REPORT NUMBER

PL-TR-92-2294

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

Proceedings of the Third International Workshop of the OAC and the NATO Advanced Research Workshop on Solar and Stellar Granulation, Capri, Italy 21-25 June 1988

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; Distribution unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

ABSTRACT. Results of both image analysis and statistical analysis of 1D scans of the IR granulation observed in the opacity minimum region are briefly presented. The same technique was applied at 600 nm and results partially presented by Koutchmy and Lebecq, 1986, *Astron. Astrophys.* 169, 323. All observations were collected at the prime focus of the Sac Peak VTT using high signal–to–noise ratio measurements with a specially–designed pinhole PbS spectro–photometer; imaging has been made using both 2D scanning of the telescope and processed video–scans of an IR–vidicon. Images of the IR granulation and of sunspot umbral dots and penumbral filaments are presented for the first time. The main results are:

14. SUBJECT TERMS	15. NUMBER OF PAGES
Photoelectric observation, Solar granulation, Infrated observations	3
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	SAR

Proceedings of the Third International Workshop of the OAC and the NATO Advanced Research Workshop on Solar and Stellar Granulation Capri, Italy 21–25 June 1988

Library of Congress Cataloging in Publication Data

Osservatorio astronomico di Capodimonte. International Workshop (3rd : 1988 : Capri, Italy)
Solar and stellar granulation : Third International Workshop of the OAC and NATO advanced research workshop, Capri, Italy, 21-25 June 1988 / edited by Robert J. Rutten and Giuseppe Severino.
p. cm. -- (NATO ASI series. Series C, Mathematical and physical sciences ; vol. 263)
"Published in cooperation with NATO Scientific Affairs Division."
Includes bibliographies and index.
ISBN 0-7923-0122-6
1. Solar granulation--Congresses. 2. Stellar granulation--Congresses. I. Rutten, Robert J. II. Severino, Giuseppe. III. North Atlantic Treaty Organization. IV. North Atlantic Treaty Organization. Scientific Affairs Division. V. Title. VI. Series: NATO ASI series. Series C, Mathematical and physical sciences ; no. 263.
QB539.G7087 1988
523.7'4--dc19 88-35031

ISBN 0–7923–0122–6

Published by Kluwer Academic Publishers,
P.O. Box 17, 3300 AA Dordrecht, The Netherlands.

Kluwer Academic Publishers incorporates the publishing programmes of
D. Reidel, Martinus Nijhoff, Dr W. Junk and MTP Press.

Sold and distributed in the U.S.A. and Canada
by Kluwer Academic Publishers,
101 Philip Drive, Norwell, MA 02061, U.S.A.

In all other countries, sold and distributed
by Kluwer Academic Publishers Group,
P.O. Box 322, 3300 AH Dordrecht, The Netherlands.

printed on acid free paper

Printed in The Netherlands

PHOTOELECTRIC ANALYSIS OF THE SOLAR GRANULATION IN IR

Serge Koutchmy

AFGL/NSO/SP, Sunspot, New Mexico 88349 (USA)
and
Paris Institut d'Astrophysique, CNRS. France

ABSTRACT. Results of both image analysis and statistical analysis of 1D scans of the IR granulation observed in the opacity minimum region are briefly presented. The same technique was applied at 600 nm and results partially presented by Koutchmy and Lebecq, 1986, *Astron. Astrophys.* 169, 323. All observations were collected at the prime focus of the Sac Peak VTT using high signal–to–noise ratio measurements with a specially–designed pinhole PbS spectro–photometer; imaging has been made using both 2D scanning of the telescope and processed video–scans of an IR–vidicon. Images of the IR granulation and of sunspot umbral dots and penumbral filaments are presented for the first time. The main results are:

A. 1. Uncorrected for the smearing RMS of intensity fluctuation at 1.75 μm are typically ± 2.1%; scans performed at cos Θ = 1, .8, and .7, corrected for the foreshortening, show a slight decrease to the limb.

2. Power spectrum analysis of the IR scans shows evidence for more power at higher frequencies, and, conversely, less power in the low frequency tail.

3. Histograms of intensity fluctuations show a more pronounced than in the optical region "bi–distribution" of intensity variations corresponding to the dark intergranular lanes (with a larger number) and to the bright granules.

4. Cross–correlation analysis of the scans shows:

   a. A typical lifetime of granules of 3.25 min instead of 6 min (decrement value) found at 600 nm with the same method.

   b. Displacements of granules in rough agreement with the solar rotation.

5. Image reconstruction of a region observed around a sunspot at cos Θ = 0.71 shows a definite positive contrast of facular features at low spatial resolution.

B. 1. Time sequences of IR diffraction–limited granulation images were obtained

R. J. Rutten and G. Severino (eds.), Solar and Stellar Granulation, 347–348.

at a slow rate of 2 images of 512x512 per sec (limited by the speed of the computer processing). Umbral dots were observed for the first time in the opacity minimum region with improved quality as far as image blurring and image motion are concerned when comparison is made with the visible image obtained simultaneously at 800 nm.

2. Although the ultimate spatial resolution achieved is far from what can be currently obtained with high speed photography in the optical region, the great advantages offered by working in IR (especially the gain offered in Zeeman sensitivity) make this technology very promising for sunspot and magnetic elements studies, including out–of–disc analysis.